Operation Manual

GuardShield™ Safe 2

Safety Light Curtain

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls (Publication SGI-1.1 available from your local Rockwell Automation sales office or online at http://literature.rockwellautomation.com/) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.

WARNING	Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
ATTENTION	Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequences.
SHOCK HAZARD	Labels may be on or inside the equipment (for example, drive or motor) to alert people that dangerous voltage may be present.
BURN HAZARD	Labels may be on or inside the equipment (for example, drive or motor) to alert people that surfaces may reach dangerous temperatures.

Conditions required for proper use of the GuardShield Type 2 Safety Light Curtain

IMPORTANT: GuardShield Type 2 devices do not meet the requirements of OSHA 1920.217, ANSI/RIA 15.06, ANSI B11.1, B11.2, B11.19 or B11.20.

Please make sure you read and understand these requirements before you select and install the GuardShield Type 2 safety light curtain. GuardShield Type 2 safety light curtains can only be used on equipment where a formal risk assessment determines that a Type 2 level of safety device is permissible.

The GuardShield Type 2 family of safety light curtains are general purpose presence sensing devices which are designed to **help protect personnel working on or near machinery.**

The installation of the GuardShield Type 2 safety light curtain must comply with all applicable federal, state and local rules, regulations and codes.

It is the responsibility of the empoyer to properly install, operate and maintain the product as well as the machinery on which the GuardShield Type 2 presence sensing device is installed.

GuardShield Type 2 safety light curtains must be properly installed by qualified personnel.

GuardShield Type 2 safety light curtains are presence sensing devices and will not protect personnel from heat, chemicals or flying parts. They are intended to signal a stop of machine motion when the sensing field is broken.

GuardShield Type 2 safety light curtains can only be used on equipment which can be stopped anywhere in its stroke or cycle, consistently and repeatably.

GuardShield Type 2 safety light curtains should never be used on full revolution clutched machinery.

The effectiveness of the GuardShield Type 2 safety light curtains depend upon the integrity of the machine control circuit. The machinery that the GuardShield Type 2 presence sensing device is installed on should have control circuitry that is of a level of safety integrity equal to or better than a category Type 2 design.

All stopping mechanisms for the machinery should be inspected regularly to **provide** proper operation. The protected machinery must have a consistent reliable and repeatable stopping time.

ATTENTION! Failure to read and follow these instructions can lead to misapplication or misuse of the GuardShield safety light curtains, resulting in personal injury and damage to equipment.

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1. Approvals and Conformity

TÜV Rheinland Product Safety GmbH, performed the CE - type examination according to the machinery directive EC/98/37, appendix VI and the respective standards ICE 61496.

The CE - conformity declaration and the product approval certification (TÜV) is available on the home-page www.Rockwell Automation.com.

All ROCKWELL AUTOMATION products are developed and manufactured following generally accepted rules in industry and in compliance with a total quality management system ISO 9001: 2000.

> ⚠ **Warning**
> GuardShield Safe 2 systems are only a safety protection device if all instructions in this manual and in the related documents are carefully followed and fully complied with. In addition the installer is respon-sible to comply with all local laws and standards.
>
> If these instructions are not (or only partially) followed, this may lead to serious injury or even death and legal action against the responsible installer or system integrator. In such a case claims against ROCKWELL AUTOMATION are not valid.
>
> This instruction manual is part of the light curtain GuardShield Safe 2. It must be kept accessible dur-ing the whole life cycle for everybody who is in charge of installation, operation, maintenance and safety control.

2. Introduction

GuardShield Safe 2 safety light curtains are active optoelectronic protective equipment (AOPE) type 2 and comply to annex IV of the European Machinery Directive EC/98/37 and IEC 61496 as a safety component.
The GuardShield Safe 2 is offered with a 30mm resolution in Guard Only mode.

2.1. System design

GuardShield Safe 2 safety light curtains consist of a transmitter and a receiver, each having a standard built-in intelligent laser alignment system ILAS. (*Figure 1*).
This allows a much easier adjustment during installation and system testing compared to conventional safety light curtains.

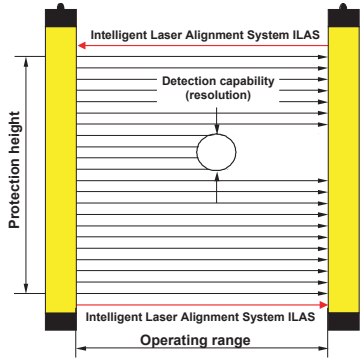


Figure 1: Main system parameters

The products are a modular construction housed in a very compact and sturdy extruded aluminium profile.

2.2. Special features

The outstanding features of the safety light curtain systems of GuardShield Safe 2 are:

- ☑ Integrated self test mode, which make an external testing unnecessary
- ☑ Configured with intelligent laser alignment ILAS
- ☑ Hand protection (30 mm resolution)
- ☑ Wide dynamic range with a compact profile type: 30 mm resolution: 0 m up to 6 m operating range,
- ☑ Max. 256 beams per system
- ☑ Tolerant to dust, dirt, pollution
- ☑ Short circuit protected semiconductor outputs
- ☑ Electrical interface compatible to industry standard
- ☑ Built-in diagnostic LED or optical interface for quick trouble shooting
- ☑ Very compact design: 30 x 40 mm (1.2” x 1.6”)
- ☑ Wide standard product range for resolution, protective height, type of application
- ☑ Optical synchronisation, no electrical cable needed between transmitter and receiver
- ☑ Maintenance-free and cost effective

3. Applications

3.1. Typical applications

Depending on the risk analysis GuardShield Safe 2 systems are used for (*Figure 2*):

- ☑ Entry / exit safeguarding
- ☑ Point-of-operation safeguarding
- ☑ Hazards area safeguarding
- ☑ Combination of entry and area safeguarding
- ☑ Combination of entry, area and point-of-opera-tion safeguarding

Typical areas of applications are:

- ☑ Processing machinery
- ☑ Conveyor machines
- ☑ Automated paint shops

Typical markets are:

- ☑ Semi conductor industry
- ☑ Paper processing
- ☑ Wood processing
- ☑ Glass manufacturing
- ☑ Textile industry

3.2. Applications restrictions

GuardShield Safe 2 is not designed and approved for any application in explosive EX or radioactive areas.
GuardShield Safe 2 does not comply with the optical requirements of a type 4 light curtain according the international standard IEC 61496.

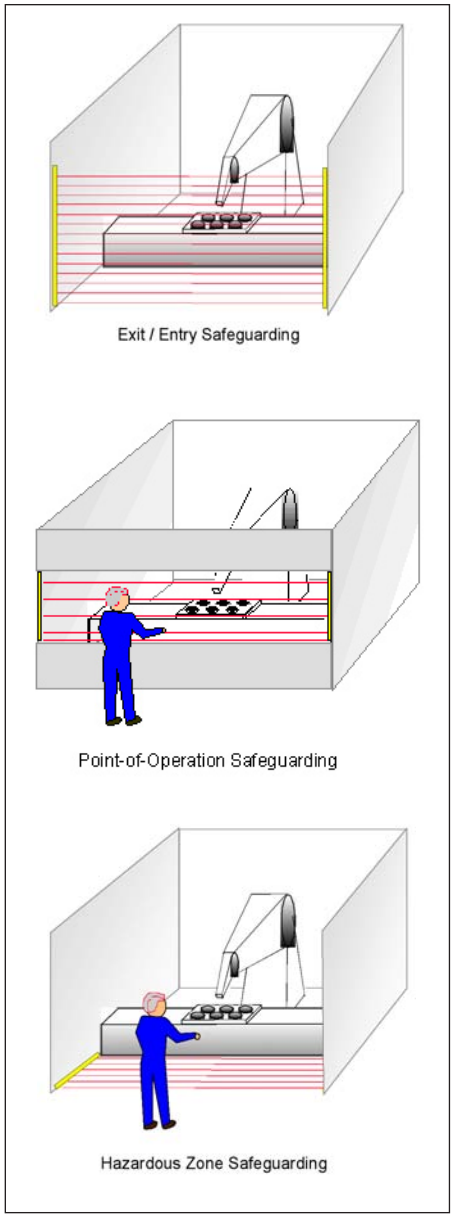


Figure 2: Typical Applications

3.3. Application Conditions

The safe application of the light curtain systems GuardShield Safe 2 needs certain precautions:

1. The control unit of the machine or system must be able to be electrically stopped and the stop time must be known.
2. The hazardous moving parts of the machine must always be stoppable and must achieve a safe position or complete standstill within the specified stop time of the machine.
3. When installing GuardShield Safe 2, the only way to access the hazard must be through the sensing field of the GuardShield Safe 2.

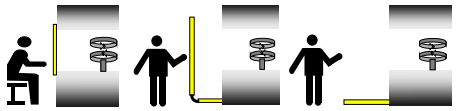


Figure 3: Correct installation

Figure 4: Incorrect installation

For the professional installation and connection, please consult the relevant laws and regulations. The safety officer of the manufacturing facilities, the local authorities (OSHA in USA, HSE in GB) or the respective industry associations as well as the intensively trained employees of ROCKWELL AUTOMATION are available for any safety related queries.

3.3.1. Corner mirrors

The protective field between transmitter and receiver can be guided around a corner using a mirror to allow safeguarding of two or three hazardous areas. Note that using one mirror will help reduce maximum operating range by approx. 15 %.

It is not recommended to use more than two mirrors due to alignment difficulties that may occur.

As accessories two types of mirrors are available, with different mounting plates and sizes. Detailed information is available from ROCKWELL AUTOMATION.

4. Principles of Operation

The transmitter sends coded infrared light pulses to the receiver, which evaluates them. If an object e.g. a hand (30 mm) penetrates the protective field, the redundant solid state Output Signal Switching Devices (OSSD) of the receiver switch off to stop the machine. As soon as the protective field is cleared, both outputs switch on again (automatic restart).

4.1. Mode of operation

GuardShield Safe 2 operates in the guard only mode with automatic restart.

4.2. Intelligent Laser Alignment System ILAS

The ILAS is a most convenient feature to make alignment a pleasure. The ILAS can be activated at any time during installation or operation. It provides the possibility to check if the light curtain is still perfectly aligned.

4.3. Perimeter systems

Perimeter systems are usually produced by means of several single beam light barriers. But the flexibility of the GuardShield Safe 2 system allows also the production of vertical entry safeguarding according to the standard EN 999. Such systems are composed of active and passive elements in one compact pro-file. The element length of each is 120 mm.

The big advantage of GuardShield Safe 2 Perimeter systems is the easy way of mounting and the uncomplicated way of starting up the operation. The time needed to connect the wires and aligning the optics is drastically reduced in comparison to standard Perimeter systems consisting of single beam light barriers, where often mirrors are also included which can only be positioned with difficulties.

The protective field and the active elements respectively, are clearly recognized as black surfaces with the integrated optical lenses. The not monitored areas (passive elements) are also clearly indicated as yellow surfaces.

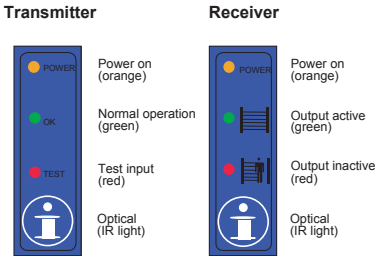


Figure 5: LED Indicators

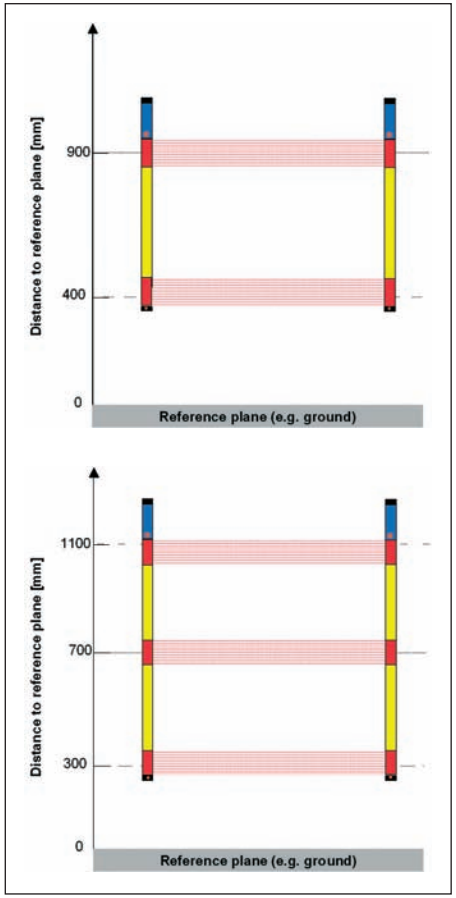


Figure 6: Perimeter Systems (2 and 3 beams), accord. to EN999 (1998)

5. Installation

5.1. Regulations and standards

The compliance with the fundamental health & safety requirements as detailed in the EU Machinery Directive EC/98/37 has to be achieved with the correct implementation of safety components. With the help of a hazard analysis as laid out in EN 292 and EN 1050, a comprehensive safety evaluation has to be made when designing and planning machinery and machinery control equipment. If Active Optoelectronic Protective Devices (AOPD) is used, the required safety distances, sufficient protective height and all application conditions must be considered during the planning phase.

5.1.1. Safety distance to danger point

According to the standards, the GuardShield Safe 2 light curtain and the point of danger must be separated by a defined safety distance. This minimum distance safeguards that the danger point may only be reached after the hazardous motion has stopped. The safety distance (see also standards EN 294, EN 775, EN 811, EN 999) depends on

- Machine stop time
- Response time of the protective device (light curtain + safety relays)
- Resolution of the protective device
- Approaching speed to the danger point
- Position of the AOPD

The approaching speed is dependent on safety distance **S** as follows:

S ≤ 500 mm, speed = 2 mm / ms
S > 500 mm, speed = 1.6 mm / ms

In cases of 'vertical' installation of the light curtains within an industrial environment and a resolution of the light curtain system **d**, (where 14 mm ≤ **d** ≤ 40 mm), the safety distance **S** to the point of danger is calculated according to the formula:

For 100 mm ≤ S ≤ 500 mm:
S = 2 mm / ms x T + 8 x (d - 14)

For S > 500 mm
S = 1.6 mm / ms x T + 8 x (d - 14)

S = Safety distance in mm
T = Total response time in ms (machine stop time + GuardShield Safe 2 response time + safety relay response time)
d = Resolution of GuardShield Safe 2 in mm

In the case of perimeter systems (chapter 4.5) or light curtains with a resolution d > 40 mm the safety distance is calculated for vertical mounted light curtains and horizontal approach, according to the formula:

S = 1.6 mm / ms x T + 850 [mm]

More detailed information regarding safety distance and safety height can be found in EN 999 or EN 294, depending on mounting type of application.

5.1.2. Height of protective field

The protective field is clearly visible as the black area with the optical lenses on the transmitter and receiver.

In addition the height of the protective field A is found on the label of each system and in the selection tables, described in chapter 8.2 (resolution 30 mm).

> ⚠ **Warning:**
> The laser beams of the ILAS are not part of to the protective field.
> Use only the protective field as mentioned on the product label. Otherwise serious injury or death may occur.

5.1.3. Response time – light curtain

The response time t_R is found on the product label, Configuration Tool or from the selection tables 8.2.

5.1.4. Distance to reflective surfaces

Reflective surfaces may cause reflections within the transmitter and receiver aperture angle, i.e. an interruption of the protective field would not be recognized (*Figure 7*).

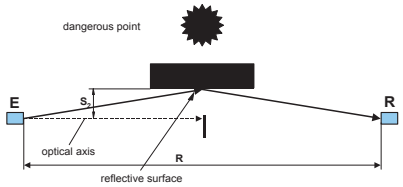


Figure 7: Distance to reflective surfaces

Should reflective surfaces arise, i.e. aluminium container passing near the light curtain or if the danger point itself is reflective, i.e. a steel blade, the safety distance S_2 must be increased, such that no reflective surface lies within the distance S_2.
The increase of the safety distance is dependant of the actual operation range R according to IEC 61496 and may be calculated as follows:

GuardShield Safe 2:
S2 = 131 mm **for R < 3 m**
S2 = R x 0.0437 **for R ≥ 3 m**

5.1.5. Multiple light curtain arrangement

When using several optoelectronic safety devices in the same application, the systems should be installed in such a way that they cannot interfere with each other. Care must be taken that each receiver only receives light from its own transmitter (*Figure 8*).

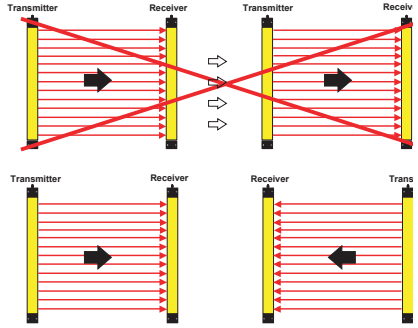


Figure 8: Multiple light curtain arrangement

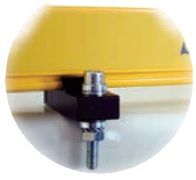
The safety light curtain has been thoroughly tested against light interferences according to the stringent requirements of IEC 61496. Nevertheless any direct interference into the receiver with other infrared sources like through beam photoelectric sensors, laser scanner, transmitters etc. should be avoided.
Mechanical installation
Be aware that a rigid, flat base, isolated against shock and vibration should be selected to mount the GuardShield Safe 2. This in combination with the standard mounting brackets set will keep the initial alignment during operation even in harsh industrial environments.

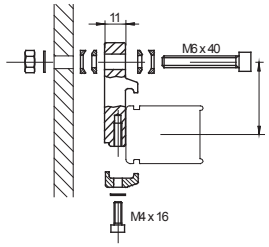
5.1.6. Mounting brackets

The backside of the light curtain profile has continuous grooves to fix the mounting brackets at any position along the light curtain housing (*Figure 18*).

Each system is delivered with four mounting brackets.

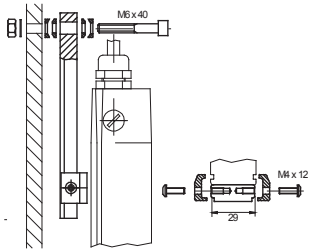
Available mounting brackets (*Figure 9*):
- Vertical mounting brackets for mounting the light curtain in the vertical axis of the light curtain. (± 4° adjustable)
- POC AND SICK FGS mounting profiles (not adjustable)





Standard mounting brackets

- For side mounting
- Adjustable by ± 4°

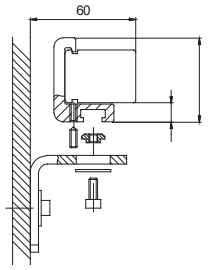


Vertical mounting brackets (optional)

- For mounting in the vertical axis of the light curtain
- Adjustable by ± 4°

POC AND SICK FGS mounting profile (optional)

- A special profile which is compatible with existing POC AND SICK FGS-mountings.
- Adjustments has to be made with the POC AND SICK FGS-mountings, if available.



180° Mounting, rotation ± 90°, for applications where the mounting angle is not set using the mounting frame.

Figure 9: Different mounting brackets for a GuardShield Safe 2 / Safe4

The mounting brackets contain all necessary mounting parts and a separate instruction sheet to ensure that the parts are assembled properly.

5.1.7. Intelligent Laser Alignment System ILAS

WARNING: Class 2 Laser
Do not expose your eyes to the laser beam to prevent exposure to dangerous radiation!
Turn **ILAS** off if not used!

To switch on ILAS:
- Touch the hand symbol ☞

Operation: Laser beam is blinking

To switch off ILAS:
- Touch the hand symbol ☞ again
- Automatically after 5 minutes

5.1.8. Adjustment Procedure without ILAS

1. Mount the transmitter and the receiver with the adjustable mounting brackets. Make sure that the longitudinal axis of both are oriented parallel. A spirit level might help to find the correct position.
2. Take care that the receiver and transmitter are oriented in the same direction. This means, the controllers of the transmitter and receiver have to be at the same end of the protective field.
   It is not allowed to mount GuardShield Safe 2 systems turned by 180° (*Figure 10*).

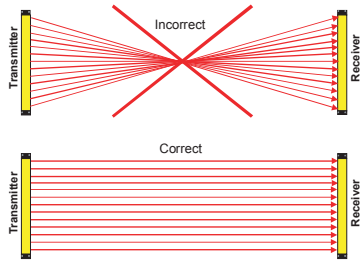


Figure 10: Layout of the transmitter / receiver

3. After aligning the longitudinal axis of transmitter and receiver, rotate the receiver around the longitudinal axis to find the receiving angle. During rotation, the receiving angle is shown when the green LED of the receiver controller is on.
4. Adjust the receiver to the centre point of the operating angle, and tighten.
5. After aligning the receiver rotate the transmitter to find the emitting angle. During rotation, the emitting angle is shown when the green LED of the transmitter controller is on.
6. Adjust the transmitter to the centre point of the operating angle, and tighten.
7. Control the operation of the GuardShield Safe 2 light curtain by using the test rod (*Figure 12*). Introducing the test rod into the protective field at any position must lead to a protective field interruption (shining of the red LED on the receiver).

When mounting Perimeter Systems adjust the heights according to the recommendations in the standard EN 999.

5.1.9. Adjustment Procedure with ILAS

1. Mount the transmitter and the receiver with the adjustable mounting brackets. Look for that the longitudinal axis of both are oriented parallel. Take care that receiver and transmitter are orented in the same direction. This means, the controllers of transmitter and receiver have to be at the same end of the protective field. It is not allowed to mount GuardShield Safe 2 systems turned by 180° (*Figure 10*).
2. The ILAS is activated by touching the hand symbol at the transmitter resp. at the receiver.
3. Adjust the transmitter and receiver in a way that both laser points hit the laser target on the opposite unit. Small deviations are harmless as long as they are within the aperture angle.
4. Tighten all screws firmly.
5. Switch the ILAS off when aligned.
6. Control the operation of the light curtain by using the test rod (*Figure 12*). Introducing the test rod into the protective field at any position must lead to a protective field interruption (shining of the red LED on the receiver).

5.1.10. Remarks to ILAS

Due to dimensional tolerances the red ILAS light spot deflects from the target center when the light curtain is aligned optimal in the center of the operating range. The optimal operating point can be found after alignment with ILAS (chapter 5.1.9) when moving the axis in X- (left, right) and Z- (up, down) direction. The optimal operating point is in the middle of the two end points, where the receiver output switches from active to inactive condition.

On optimal alignment of the light curtain the ILAS light point can deflect from the ILAS target point. The maximum deflection adds up to the following value due the operating distance:

2 m	R = 7 mm	D = 7 mm
6 m	R = 20 mm	D = 21 mm
9 m	R = 30 mm	D = 32 mm
18 m	R = 60 mm	D = 63 mm
30 m	R = 99 mm	D = 105 mm

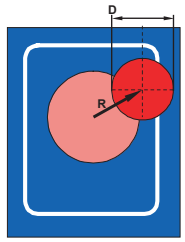


Figure 11: Adjustment with ILAS

5.1.11. Testing the protection field

After Installation and Alignment of the GuardShield Safe 2 safety light curtain, the protection field has to be tested with the test rod for the corresponding resolution (30 mm) according *Figure 12*.

When mounting Perimeter Systems adjust the heights according to the recommendations in the standard EN 999, RIA 15.06 or according to the prevailing local regulation.

Figure 12: Correct testing of the protective field using a test rod

5.2. Electrical Installation

5.2.1. Connection diagram

The transmitter and receiver are connected to the machine control using a 5-wire cable.

For the transmitter and the receiver two M12 (for cable - Ø 3 ... 6.5 mm)

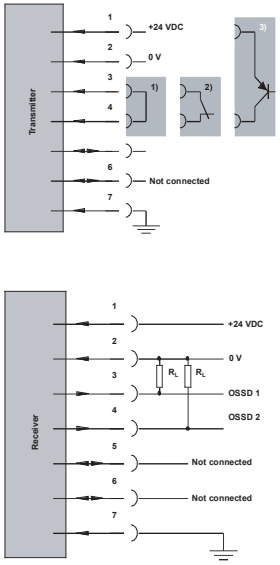


Figure 13: Terminal block connection (see also Figure 18)

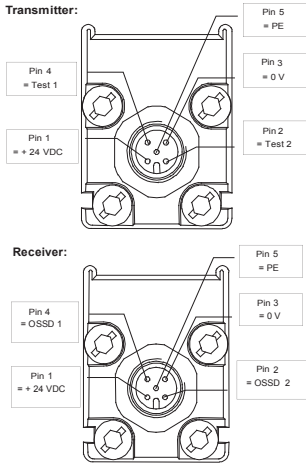


Figure 14: M12/5 Pin connector

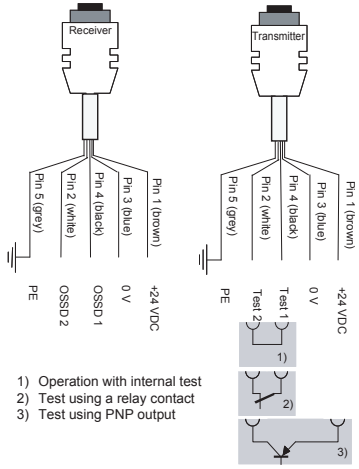


Figure 15: Wiring of the connecting cables of the M12/5 Pin connector

Transmitter and receiver are supplied with M12/5 pin connectors The wiring is given in *Figure 14* and *Figure 15*.

5.2.2. Test input to transmitter

Normally the test input at the transmitter is installed with a short circuit jumper to activate the transmitter. If an external test is desired, a contact can be connected to the test input (*Figure 13*).

The following points have to be considered:

- In case of operation in the modus “self monitoring” both OSSD outputs have to be connected separately to the safety switching of the machine.

⚠ **GuardShield Safe 2:**

- In case of connecting an external test it could be that, depending on the test type, only one OSSD output (OSSD1 or OSSD2) has to be considered.

The timing of test input is as follows (*Figure 16*):

	Time	Value in ms
Response time on test signal	t_1	≤ t_R + 15
Time to test	t_2	> t_1
Restart time after test	t_3	≤ 800

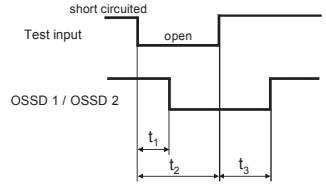


Figure 16: Test timing diagram

t_R means the response time of the respective GuardShield Safe 2 type (see product label).

Internal test	Description	Value
Continuous test current	I	10 mA
Peak test current	I_P	100 mA
Time of peak test current	t_P	20 µs

Internal test	Transmitter	Test LED Transmitter
Short circuited (closed)	Active	Green
Open	Inactive	Red

5.2.3. Power supply

GuardShield Safe 2 safety light curtains are devices of electrical safety level III (extra low voltage). 24 VDC ± 20 % has to be supplied by a power supply that complies with IEC / EN 60204 and IEC / EN 60742. Such a power supply meets the electrical safety requirements and maintains the minimum power of 18 VDC during 20 ms even in the event of voltage dips.

5.2.4. Bringing into operation

After the power supply has been applied to the GuardShield Safe 2 and the automatic power-up test is successfully completed (power up test time < 3 s) the green LED on the receiver and transmitter will light on. The system is now ready to operate.

The automatic power-up test will only be successful, if the transmitter and receiver are properly aligned, correctly connected and the protective field is not interrupted.
Any intrusion of an object into the protective field will switch the OSSDs off within the specified response time and the LED at the receiver toggles from green to red.

5.2.5. Outputs

The two redundant Output Signal Switching Devices (OSSD) are fully monitored. Any short circuits are detected. The maximum load is 0.4 A, higher currents are limited through short circuit protection. Increased output loads may be realized using external safety interfaces.

⚠ **Important information:**
Safety devices for connection of GuardShield Safe 2 the must be built with PNP logic. The outputs will be periodically controlled for short-circuit and cross-fault detection.

The output voltage at the solid-state outputs is dependant on the power supply and the output load (see chapter 11 Technical Data).

5.2.6. Trouble shooting

Possible errors and operation status are indicated with the LED indicators on the transmitter and receiver. Also the Optical Interface has an option that can be used for the diagnostics
Following combinations are relevant:

Table 1: Transmitter

Status	LED		
	Orange (Power)	Green (ok)	Red (Test)
No power supply (external)	off	off	on
Test input closed (external)	on	on	off
Test input open (external)	on	off	on
Controller error (internal)	flashing	off	on
Protective field error (internal)	flashing	off	flashing

Table 2: Receiver

Status	LED		
	Orange (Power)	Green (Protective field not interrupted)	Red (Protective field interrupted)
No power supply (external)	off	off	off
No sufficient power (external)	on	off	off
OSSD on (on-load operation, protective field not interrupted, normal)	on	on	off
OSSD off (off-load operation, protective field interrupted or insufficient alignment of the system)	flashing	off	on
OSSD error (external, short circuit between OSSD 1 and OSSD 2, towards 0 V and off 24 VDC)	all 3s short time	off	flashing
Controller error (internal)	irregular flashing	off	on
Protective field error (internal)	flashing	off	flashing

External error: An external interface error can be resolved by correcting the installation, due to

1. Receiver: short circuit of both OSSDs, of OSSD to U_{sp}, of OSSD to GND
2. Transmitter: Test input open
3. No or too low power supply

Internal error (orange LED is irregularly flashing): Please contact the nearest ROCKWELL AUTOMATION representative.

Normal operation

Transmitter	Receiver	Operation status
Test input closed	OSSD on	Protective field free
Test input closed	OSSD off	Protective field interrupted
Test input open	OSSD off	Test active

5.2.7. Optical Interface

As an accessory Rockwell Automation offers an Optical Interface including a software package for extended diagnostic purposes.

Figure 17: Optical Interface

The adapter may be snapped on the controller during normal operation and may be connected via the interface to a MS-Windows personal computer for diagnoses purposes. A detailed description about extended diagnostic features is shipped with the diagnostic package.

The Optical Interface offers apart from the diagnosis of operating conditions, the possibility to select and analyse the length of the interrupted protective field.

6. Interfacing to safety devices

The interfacing of the light curtain with the machine control has to be control reliability, i.e. a correct interface with a safety PLC or safety relays with positive guided relay contacts.
Figure 18 - Diagram for automatic reset mode - shows a diagram of a typical emergency stop relay component.

Other applications are mentioned in the application note “Safety Interfaces with GuardShield Safe 2”, on the ROCKWELL AUTOMATION homepage.

⚠ Danger ⚠
The safety devices and the interconnection to the machinery have to comply with the basic safety requirements as mentioned in the current regulations and standards.

Direct interfacing of a safety light curtain to machine control that does not meet the necessary safety integrity level, i.e. use of general purpose PLCs or general purpose relays can cause serious injury or death of persons.

Consult a professional safety engineer!
⚠ Danger ⚠

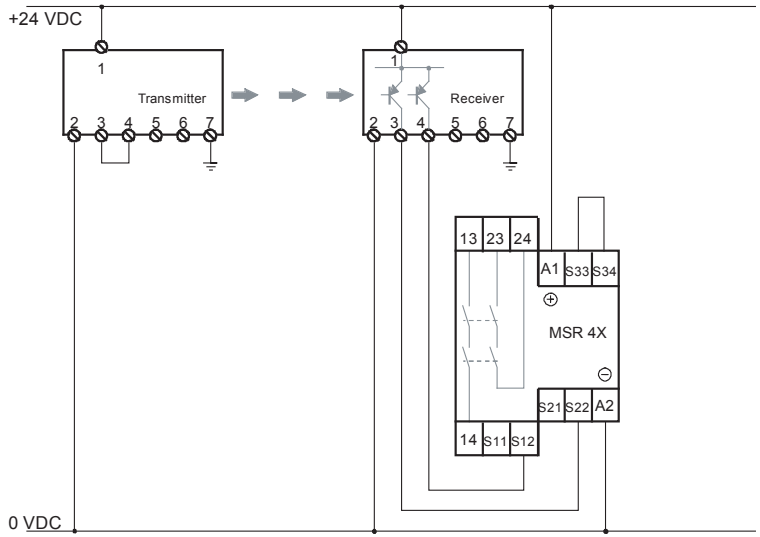


Figure 18: Diagram for automatic reset mode with ROCKWELL AUTOMATION MSR 42

7. Dimensional drawings

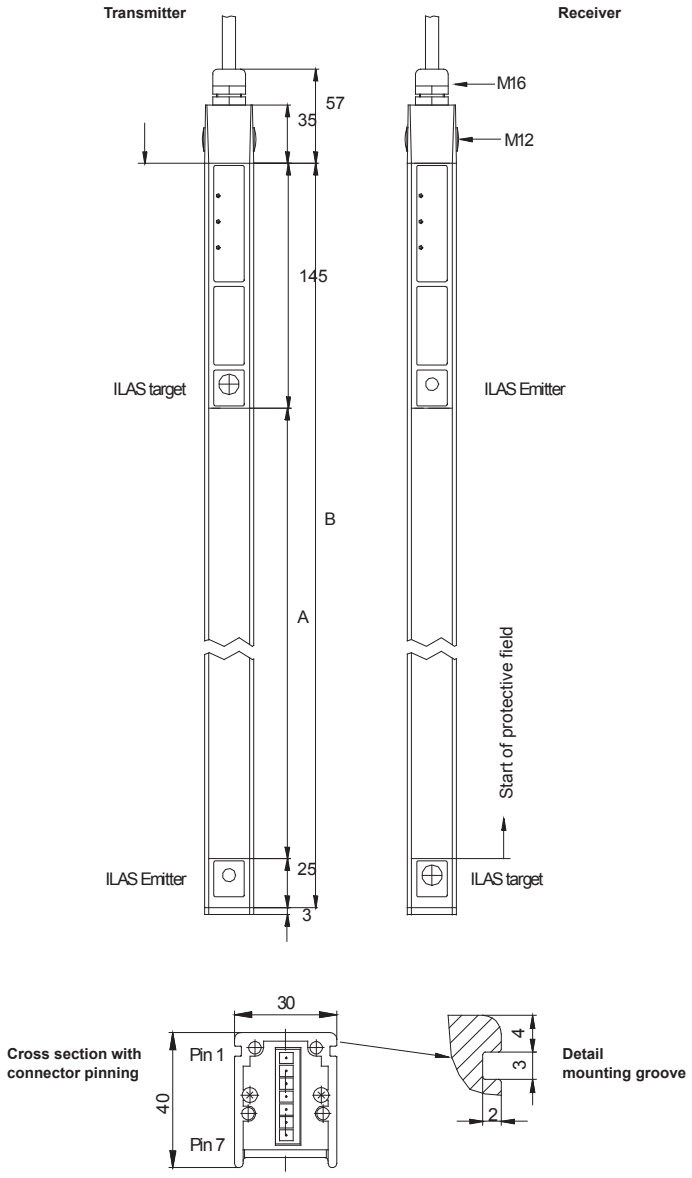


Figure 19: Dimensional drawing, cross Section

8. Selection of a safety light curtain

8.1. Check list

In consideration of following points the selection of a proper GuardShield Safe 2 safety light curtain will be simplified:

1. **Regulations**
   Look up carefully the actual regulations and codes applicable to the particular application in your country. Local authorities and professional organisations as well as ROCKWELL AUTOMATION representatives will provide necessary assistance.
   USA: Occupation Safety and Health Administration OSHA, others like ANSI, RIA and further professional organisations
   GB: Health and Safety Executive HSE, safety consultants and professional organisations

2. **Protective field**
   Determination of
   - required operating range,
   - protective height (available in increments of 120 mm),
   - resolution (object detection capability: 30 mm)
   - and configuration of light curtain (special configuration with extension modules)

   Operating range, protective height and special configuration must be chosen so that the danger points are only accessible through the protective field.

3. **Response time**
   The response time $t_{R\text{-}BWS}$ of GuardShield Safe 2 can be found on the product label and in the selection table (next section). The response time can also be calculated with the Optical Configuration Tool.

4. **Corner mirrors**
   Using corner mirrors allow safeguarding two or three protective fields with one light curtain.
   Each corner mirror reduces the operating range by approximately 15 % per mirror.

8.2. Selection table

Table 3: 30 mm resolution with ILAS

Catalog No.	Protective height A (mm)	Total length B (mm)	Response time t_R (ms)	Max. range (m)	Resolution (mm)	Weight per pair (kg)
445L-P2S0120YD	120	290	7.8	6	30	1.0
445L-P2S0240YD	240	410	10.5	6	30	1.4
445L-P2S0360YD	360	530	13.1	6	30	1.8
445L-P2S0480YD	480	650	15.8	6	30	2.2
445L-P2S0600YD	600	771	18.4	6	30	2.6
445L-P2S0720YD	720	891	21.1	6	30	3.0
445L-P2S0840YD	840	1’011	23.7	6	30	3.5
445L-P2S0960YD	960	1’131	26.3	6	30	4.0
445L-P2S1080YD	1’080	1’252	29.9	6	30	4.0
445L-P2S1200YD	1’200	1’372	31.6	6	30	4.5
445L-P2S1320YD	1’320	1’492	34.3	6	30	5.0
445L-P2S1440YD	1’440	1’612	36.9	6	30	5.5
445L-P2S1560YD	1’560	1’733	39.6	6	30	6.0
445L-P2S1680YD	1’680	1’853	42.2	6	30	6.5
445L-P2S1800YD	1’800	1’973	44.9	6	30	7.0
445L-P2S1920YD	1920	2093	47.6	6	30	7.5

8.3. Accessories / Components

Table 4

ROCKWELL AUTOMATION Part No.	Description
445L-AC5SH-5	5 m PVC shielded cable with M 12 / 5 pin connector, *Figure 13*
445L-AF6140	Standard mounting kit (4 pieces)
445L-AF6141	Adjustable mounting kit
445L-AF6142	Shock mount kit
445L-AF6144	Mounting kit for POC AND SICK FGS adapter (4 pieces)
445L-AF6150	Optical Interface (incl. software)

Table 5 - Corner Mirror

GuardShield Safe 2 / Safe 4 Protective Height (mm)	Narrow Corner Mirror, short range 0...4M	Catalog Number	Wide Corner Mirror, Long range 4...15M	Catalog Number
120 / 240		440L-AM0750300		440L-AM1250300
360		440L-AM0750450		440L-AM1250450
480 / 600		440L-AM0750600		440L-AM1250600
720		440L-AM0750750		440L-AM1250750
840		440L-AM0750900		440L-AM1250900
960		440L-AM0751050		440L-AM1251050
1080 / 1200		440L-AM0751200		440L-AM1251200
1320		440L-AM0751350		440L-AM1251350
1440		440L-AM0751500		440L-AM1251500
1560		440L-AM0751650		440L-AM1251650
1680 / 1800		440L-AM0751800		440L-AM1251800
1800		None Available		None Available

9. Inspection and service

All light curtains contain only electronics and therefore need limited maintenance.

9.1. Cleaning

The optical windows are to be cleaned with non-aggressive materials only. The interval between cleaning is dependant on the air pollution at the installation.

⚠Do not use aggressive solvents or abrasive substances. Otherwise range reduction and false switching could arise.

9.2. Inspections

The light curtain must, depending on the valid regulations, be periodically tested by qualified and trained persons.

The function of the light curtain can be tested with the supplied test rod, which has a diameter corresponding to the resolution of the light curtain. The status is indicated through the LED display in the ROCKWELL AUTOMATION GuardShield Safe 2 light curtain.

Functional Test
The function of the light curtain can be tested using the test rod, (*Figure 12*), which has a diameter corresponding to the resolution of the light curtain. The status is displayed at the LED on the transmitter or receiver. The status can be easily read from the trouble shooting labels “Transmitter Status” and “Receiver Status” (*table 1 and 2*, page 13).

9.3. Decommissioning

The safety light curtain may only be removed, if the machinery or assembly line will be closed definitively. This has to be done by removing the main supply from the machinery. It must be impossible to bring the machinery into operation without using tools.
The light curtain can be reused provided the current regulations are taken into consideration.

If the light curtain has to be disposed, it can easily be disassembled and recycled using state of the art recycling technology and following current disposal regulation. It does not contain harmful materials except small quantities of materials used in electronic PCBs.

10. Technical Data

Table 6

Description	Value	Remarks
Profile length	120 ... 1920	120mm increments
Operating range	0 ... 6 m,	Resolution 30 mm
Object detection capability (Resolution)	30 mm	
Power supply U_{sp}	24 VDC ± 20 %	PELV, IEC 60 204-1
Power supply ripple	< 10 % of U_{sp}	
Equipment Class	III	VDE 0106 part 100
Time for self check when switching on U_{sp}	< 3 s	
Current consumption	< 500 mA	No-load operation
Outputs, short circuit proof	2 x PNP, 0.3 A	Max. capacitive load 0.5 µF
Output voltage	> U_{sp} – 1	Load 0.1 A
Response time t_{R-BWS}	Selection table	
Connector	M 12, 5-Pin	
Connection cable	Max length 5M	
Cross section max.	1.5 mm^2	
Outside diameter of cable	3 ... 6.5 mm	for M12
Mode of operation	Guard only with automatic restart	
Safety category	Type 2	IEC 61496
Standards	IEC 61496 part1+2	
Electromagnetic compatibility (EMC)	IEC 61 496 part 1	
Enclosure rating	IP65	
Temperature range	0 ... +55°C -20 ... +60°C	Operation with ILAS Storage / transport
Relative air humidity	15 ... 95 %	Not condensing
Enclosure	Aluminum profile 30 x 40 mm	
Optical window	Polycarbonate, bonded	
Enclosure treatment	Polyester powder coated	
ILAS	Laser class 2	EN 60 825
Dimensions	Dimensions and selection tables	
Weight	Selection tables	

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